REMARKS

In the last Office Action, the Examiner pointed out that applicant has not yet filed a certified copy if his corresponding Japanese patent applications of which priority is claimed. Applicant notes that such will be filed at the time of payment of the issue fee herein.

Claims 1 and 8-10 were objected to based on a minor informality. Claims 8 and 9 were rejected under 35 U.S.C. §112, first paragraph, as containing subject matter that is not described in the specification. The Examiner stated that the specification does not support the limitation that the control circuit reduces the boosted voltage. Claims 1 and 4-7 were rejected under 35 U.S.C. §102(b) as being anticipated by Sameshima and under 35 U.S.C. §102(e) as being anticipated by Nagumo. Claim 3 was rejected under 35 U.S.C. §103(a) as being unpatentable over Sameshima and Nagumo, taken independently. Claims 8 and 9 were rejected under 35 U.S.C. §103(a) as being unpatentable over Sameshima in view of Cato, Nagumo in view of Cato, and Hoshino in view of Cato. Claims 1-7, 10-16 and 18-22 were rejected under 35 U.S.C. §103(a) as being unpatentable over Hoshino in view of Sameshima. Claims 17 and 23 were rejected under 35 U.S.C. §103(a) as being unpatentable over Hoshino in view of Sameshima and further in view of Cato.

By the present response, claims 1-4, 6-10 and 12-17 have been amended to overcome the Examiner's objection by reciting a "light emitting diode" in the preamble. Independent claims 1 and 10 have been amended to more particularly point out and distinctly claim the novel features of the present invention by incorporating the subject matter of dependent claims 5 and 11, respectively, and to further recite that the LEDs blink in a time-division manner at a rate higher than a visual perception rate. Accordingly, dependent claims 5 and 11 have been canceled without prejudice or admission and dependent claims 2 and 4 have been amended to conform to amended independent claim 1. In addition, the dependency of claims 12-17 has been changed and claims 18-23 have been canceled to avoid redundancy. Independent claims 8 and 9 have been amended to overcome the Examiner's rejection under 35 U.S.C. §112, first paragraph, by deleting the recitation "reducing the boosted voltage" and to further recite that the LEDs are turned on and off in a time-division manner.

To provide a more comprehensive scope of coverage, new claims 24-29 have been added.

Applicant respectfully submits that claims 1-4, 6-10, 12-17 and 24-29 patentably distinguish over the prior art of record.

The present invention relates to a light emitting diode drive circuit which causes a light emitting diode to blink periodically to reduce power consumption.

In accordance with one aspect of the present invention recited by amended independent claim 1, the inventive light emitting diode drive circuit comprises a driver having a constant current circuit for driving a plurality of LEDs, a plurality of switches each connected to a respective LED for periodically turning on and off the LEDs at certain time intervals, and a switch control circuit for controlling the switches in response to an external signal to cause the LEDs to blink in a time-division manner. Independent claim 10 recites similar language.

Accordingly, each of independent claims 1 and 10 recites a switch circuit for causing an LED to blink in a time-division manner.

In accordance with another aspect of the invention recited by amended independent claim 8, the light emitting diode drive circuit comprises a driver circuit having a boosting circuit for boosting a power source voltage and outputting a boosted voltage, and a constant current circuit for producing a constant current for driving an LED, and a control circuit for controlling the boosting circuit for boosting the power source voltage when the constant current is

smaller than a predetermined value, and for not boosting the power source voltage when the constant current has the predetermined value or more, such that the LEDs are periodically turned on and off at certain time intervals in a time-division manner based on operation of the boosting circuit. Independent claim 9 contains similar language.

In the embodiment illustrated in Fig. 11 of the application drawings, for example, the inventive LED drive circuit has a constant current generating circuit 15 for generating a constant current. A reference voltage circuit 11 in the constant current generation circuit 15 is supplied with power through a power supply terminal 10 connected thereto. A boosting circuit 101 boosts the voltage Vdd applied to the power supply terminal 10 to a higher voltage VDDU obtained through a terminal 100. An output of a comparator 60 is connected to the boosting circuit 101. Control of the ON/OFF state of the boosting circuit 101 is performed on the basis of the output voltage of the comparator 60. The positive terminal input voltage Vref of the error amplifier circuit 12 in the constant current generating circuit 15 is connected to the positive terminal of the comparator 60, while the negative terminal input voltage Va of the error amplifier circuit 12 is connected to the negative terminal of the comparator 60.

The boosting circuit 101 performs boosting when the output voltage of the comparator 60 is high, i.e., when Vref is less than Va, and stops boosting when the output voltage of the comparator 60 is low. This enables the LEDs to be driven at the optimum boosted voltage VDDU.

No corresponding structure is disclosed or suggested by the prior art of record.

The cited references to Sameshima, Nagumo and Hoshino each disclose an LED drive circuit having various elements recited by amended independent claims 1 and 8-10, such as switch elements connected to plural LEDs for controlling the ON/OFF state thereof. In addition, Hoshino discloses a drive circuit for causing the LEDs to blink at a rate higher than a visual perception rate.

However, as discussed above, amended independent claims 1 and 10 require that each LED blinks in a time-division manner. This feature of amended independent claims 1 and 10 is absent from the cited references. In the absence of any disclosure of this explicitly recited feature of the present invention, anticipation under 35 U.S.C. §102 cannot be found. See, e.g., W.L. Gore & Associates v. Garlock, Inc., 220 USPQ 303, 313 (Fed. Cir. 1983), cert. denied, 469 U.S. 851 (1984) ("Anticipation requires the disclosure in a single prior art reference of each element of the claim under consideration").

Nor are amended independent claims 8 and 9 rendered obvious over Sameshima in view of Cato, Nagumo in view of Cato, or Hoshino in view of Cato.

As described above, amended independent claims 8 and 9 require a driver circuit having a boosting circuit for boosting a power source voltage and a constant current circuit for producing a constant current for driving LEDs, and a control circuit for controlling the boosting circuit to boost the power source voltage when the constant current is smaller than a predetermined value, and to not boost the power source voltage when the constant current has the predetermined value or more, such that the LEDs are periodically turned on and off in a time-division manner based on operation of the boosting circuit.

Although Sameshima, Nagumo and Hoshino disclose LED drive circuits having switch elements and Hoshino and Cato disclose a boosting circuit, none of the cited references taken alone or in combination would have fairly suggested the invention recited by amended independent claims 8 and 9, which requires the turning on and off of LEDs in a time-division manner based on operation of a boosting circuit.

For instance, Hoshino discloses an LED drive circuit that includes a booster circuit having a charge pump. The charge pump comprises an oscillator circuit which generates a

pulse signal having a frequency in the range of 100-700 kHz. However, the pulse signal does not turn on and off the LEDs in a time-division manner.

Cato discloses an LED driver circuit having a boosting circuit for boosting a power source voltage and a control circuit for controlling the boosting circuit. However, the boosting operation does not cause the LEDs to turn on and off periodically in a time-division manner.

In accordance with the present invention, the boosting operation turns on and off a plurality of LEDs in a time-division manner to reduce power consumption of the circuit. The combined teachings of the cited references fail to disclose or suggest the subject matter of amended independent claims 8 and 9.

Accordingly, applicant respectfully submits that amended independent claims 1 and 8-10 patentably distinguish from the prior art of record and that the prior art grounds of rejection asserted by the Examiner should be withdrawn.

Dependent claims 2-4, 6, 7, 12-18 and 24-29 depend upon and contain all the limitations of the base claims described above and are patentable for the reasons discussed above.

In view of the foregoing amendments and discussion, the application is believed to be in condition for allowance. Accordingly, favorable reconsideration and allowance of the claims are most respectfully requested.

Respectfully submitted,

ADAMS & WILKS
Attorneys for Applicant

By: _____
Bruce L. Adams
Reg. No. 25,386

50 Broadway - 31st Floor
New York, NY 10004
(212) 809-3700

MAILING CERTIFICATE

I hereby certify that this correspondence is being deposited with the United States Postal Service as first-class mail in an envelope addressed to: MS NON-FEE AMENDMENT, COMMISSIONER FOR PATENTS, P.O. Box 1450, Alexandria, VA 22313-1450, on the date indicated below.

Paul Hoffman
Name

_____
Signature

April 29, 2004
Date